MULTIMEDIA UNIVERSITY®

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 [TERM ID 2210]

HMB2011 – INTRODUCTION TO MOLECULAR BIOLOGY

(All section / Groups)

9 FEBRUARY 2023

2:30 p.m. – 4:30 p.m

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **5 pages** with **4 Questions** only.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.
4. You can use calculator in the examination.

QUESTION 1

(a) What do operons do in prokaryotes? [1 mark]

(b) In *E. coli*, the trp operon is on by default, while the lac operon is off. Explain why the default condition of both operon are as such? [2 marks]

(c) Explain why a person's DNA sequences of a muscle cell and a nerve cell are identical despite they have different functionality? [1 mark]

(d) What could be the outcome of a mutation in the 5' untranslated region (UTR) that prevented any proteins from binding to the region? [1 mark]

(e) Gene A is thought to be associated with color blindness. The protein corresponding to gene A is isolated. Analysis of the protein recovered shows there are actually two different proteins that differ in molecular weight that correspond to gene A. Describe ONE reason that may cause the scenario above. [1 mark]

(f) What are epigenetic changes? Name TWO examples of epigenetic modifications. [2 marks]

(g) How does RNA interference affect gene expression? [2 marks]

Continued...

QUESTION 2

(a) What volume of water must be added to 25 mL of a 4.0 mol/L solution of potassium carbonate solution to dilute it to a concentration of 1.6 mol/L? Show your calculations. [2 marks]

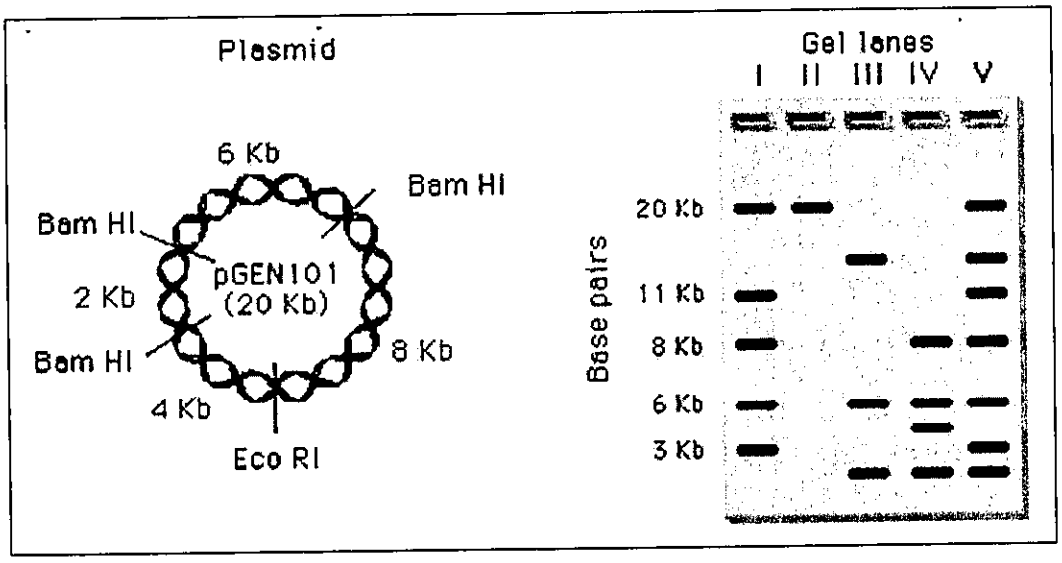
(b) How many grams of $AgNO_3$ are needed to prepare 0.125 M solution in 250 mL of water? Show your calculations. (the molar mass of $AgNO_3$ is 169.87g/ mole) [2 marks]

(c) What is "Ct value" in real-time polymerase chain reaction (PCR) and what does it tell? [2 marks]

(d) What is a Material Safety Data Sheet (MSDS)? [1 mark]

(e) How do you evaluate the purity of DNA and RNA using spectrophotometric analysis? [1.5 marks]

(f) Below is a plasmid with restriction sites for BamHI and EcoRI. Several restriction digests were done using these two enzymes either alone or in combination. The digested products were analyzed by gel electrophoresis.



i. Which lane shows a digest with BamHI only? [0.5 mark]

ii. Which lane shows a digest with EcoRI only? [0.5 mark]

iii. Which lane shows the fragments produced when the plasmid was incubated with both EcoRI and BamHI? [0.5 mark]

Continued...

QUESTION 3

(a) Why is homologous recombination process important in eukaryotes? [1 mark]

(b) How does the transposable element (Ds) cause spotted effect in corn kernal. (Diagram is not compulsory) [2 marks]

(c) How does the ethidium bromide cause frameshift mutations? [0.5 mark]

(d) How does the DNA glycosylase extrudes damaged bases? [0.5 mark]

(e) What human condition is brought on by untreated UV-induced lesions? [0.5 mark]

(f) What are TWO differences between nonhomologous end joining (NHEJ) and homologous recombination (HR)? [2 marks]

(g) What are TWO possible consequences if our body's DNA repair machinery fails? [2 marks]

(h) List THREE factors that affect hybridization experiment. [1.5 marks]

Continued...

QUESTION 4

(a) What method is used to recognise recombinant DNA? Give any TWO techniques. [2 marks]

(b) What advantage can be derived from the incorporation of a polylinker region (multiple unique restriction sites) in the lacZ component of the pUC family of plasmids? [1 mark]

(c) How do researchers isolate individual chromosomes to build a library of those particular chromosomes? [0.5 mark]

(d) Why are knockout mice used extensively in human research? Give TWO reasons. [1 mark]

(e) Cytogenetic map is visual appearance of chromosome when you examined under the microscope. Give any ONE information you can get from human cytogenetic map. [0.5 mark]

(f) What are contigs and scaffolds in the DNA sequencing technology? [1 mark]

(g) What is the purpose of RNA sequencing? [1 mark]

(h) Explain the CRISPR safety concern that has received the greatest attention. [1 mark]

(i) What is the shotgun method of sequencing? [1 mark]

(j) What is the difference between pyrosequencing and Sanger sequencing? [1 mark]

End of paper